

AMENDMENTS TO THE CLAIMS

1. (currently amended) A system for injecting one or more additives into production fluid produced by at least one subsea well, the system comprising:
 - a) a surface chemical supply unit for supplying at least one chemical to a selected subsea location;
 - b) at least one chemical supply line for carrying the at least one chemical from the surface to the selected subsea location; and
 - c) a subsea chemical injection unit at the selected subsea location receiving the at least one chemical from the surface chemical supply unit and selectively injecting the at least one chemical into the production fluid flowing from the at least one subsea well to a surface location using a subsea pump.
2. (Original) The system of claim 1 further comprising a controller that controls the amount of the at least one chemical injected in response to at least one parameter of interest.
3. (previously presented) The system of claim 2 wherein the parameter of interest is one of (i) temperature, (ii) pressure, (iii) flow rate, (iv) a measure of one of hydrate, asphaltene, corrosion, chemical composition, wax or emulsion, (v) amount of water, and (vi) viscosity.

4. (Original) The system of claim 3 further comprising at least one sensor for providing information about the at least one parameter interest, said at least one sensor being selected from a group consisting of a temperature sensor, a viscosity sensor, a fluid flow rate sensor, a pressure sensor, a sensor to determine chemical composition of the production fluid, a water cut sensor, an optical sensor, and a sensor to determine a measure of at least one of asphaltene, wax, hydrate, emulsion, foam and corrosion.

5. (Original) The system of claim 1 wherein the subsea chemical injection unit includes a storage unit for storing the at least one chemicals supplied by the surface chemical supply unit.

6. (previously presented) The system of claim 5 wherein the at least one chemical supply line includes a plurality of lines for carrying a plurality of chemicals to the subsea chemical injection unit.

7. (Original) The system of claim 6 wherein the surface chemical supply unit supplies a plurality of chemicals to the subsea chemical injection unit via the plurality of lines.

8. (currently amended) The system of claim 1 wherein the surface chemical supply unit is located on an offshore rig and the subsea chemical

injection unit is positioned proximate the at least one subsea well.

9. (Original) The system of claim 1 wherein the surface chemical supply unit includes a buoy at the sea surface and wherein the at least one chemical supply line carries chemicals from the buoy to the selected subsea location.

10. (Original) The system of claim 9 wherein the buoy includes a chemical storage unit that is periodically filled.

11. (Original) The system of claim 10 wherein the at least one supply line includes a plurality of supply lines, one for each chemical, between the buoy and the selected subsea location.

12. (Currently Amended) The system of claim 1 wherein the subsea chemical injection unit further comprises a manifold for mixing at least two chemicals prior to injecting the at least two chemicals into the production fluid as the production fluid flows from the at least one subsea well.

13. (previously presented) The system of claim 1 wherein the subsea chemical injection unit further comprises a control valve controlling the amount of the at least one chemical injected into the at least one subsea well.

14. (Original) The system of claim 1 further comprising a subsea power

unit for supplying power to the chemical injection unit.

15. (Original) The system of claim 14 wherein the subsea power unit includes an electrical battery that is periodically charged from energy supplied from a surface location.

16. (Original) The system of claim 1 further comprising a riser for transporting production fluid to the surface and wherein the at least one chemical supply line is located at one of (i) inside the riser, and (ii) outside the riser.

17. (Original) The system of claim 1 further comprising a plurality of sensors distributed along a production fluid path.

18. (Original) The system of claim 4 wherein the at least one sensor is located at one of (i) wellhead over the at least one wellbore, (ii) in the wellbore, and (iii) in a supply line between the wellhead and the subsea chemical injection unit.

19. (Original) The system of claim 1 wherein the at least one subsea well includes a plurality of wells and the subsea chemical injection unit separately supplies the at least one chemical to each said subsea well.

20. (currently amended) The system of claim 1 further comprising a

subsea fluid-processing unit receiving the production fluid via a line
coupled to the subsea wellhead, the at least one chemical being injected into
the line.

21. (currently amended) The system of claim 1 wherein the subsea chemical injection unit injects the at least one chemical into one of (i) the at least one subsea well, and (ii)-a subsea fluid processing unit, and (iii)-in a subsea pipeline coupled to the at least one subsea well and, the subsea pipeline carrying the production fluid.

22. (Original) The system of claim 1 further comprising a heating device deployed subsea to heat the production fluid.

23. (Original) The system of claim 1 further comprising a surface controller for controlling one of: (i) at least in part the operation of the subsea chemical injection unit and (ii) the supply of the at least one chemical.

24. (Original) The system of claim 23 further comprising a remote controller providing command signals to the surface controller to control the injection of the at least one chemical.

25. (Original) The system of claim 1 further comprising a plurality of

distributed sensors associated with said at least one chemical supply line for providing signals relating to a characteristic of the at least one chemical carried by the at least one chemical supply line.

26. (Original) The system of claim 25 wherein the surface chemical supply unit controls the supply of the at least one chemical in response to the signals relating to the characteristic of the at least one chemical in the supply line.

27. (Original) The system of claim 22 further comprising a power unit at the surface that provides power to the heating device.

28. (Original) The system of claim 20 wherein the processing unit refines at least partially the production fluid.

29. (Original) The system of claim 28 further comprising a fluid line carrying processed fluid from the processing unit to the surface.

30. (currently amended) A flow assurance method for fluid produced by at least one subsea well comprising:

- a) providing a surface chemical supply unit at a location remote from the at least one subsea well for supplying at least one chemical to a selected subsea location;
- b) providing at least one chemical supply line for carrying the at

- least one chemical from the surface to the selected subsea location;
- c) measuring a parameter of interest relating to a characteristic of the production fluid; and
 - d) providing a subsea chemical injection unit at the selected subsea location for receiving the at least one chemical from the surface chemical supply unit via the at least one chemical supply line and for selectively pumping the at least one chemical into the production fluid flowing from the at least one subsea well to a surface location using a subsea pump , at least in part in response to the parameter of interest

31. (Original) The method of claim 30 wherein measuring the parameter of interest includes measuring one of temperature, viscosity, fluid flow rate, pressure and chemical composition of the produced fluid, a measure of asphaltene, wax, hydrate, emulsion, foam, corrosion, or water, and an optical property of the production fluid.

32. (Original) The method of claim 30 further comprising locating an end of the at least one chemical supply line at a buoy at the water surface.

33. (Original) The method of claim 32 further comprising moving the surface chemical supply unit to the buoy to supply the at least one chemical to the subsea chemical injection unit via the at least one supply line.

34. (Original) The method of claim 32 wherein the at least one supply line includes a plurality of supply lines and the surface chemical supply unit pumps a separate chemical through each of the plurality of supply lines.
35. (previously presented) The method of claim 30 wherein the subsea chemical injection unit includes: (i) a flow control valve; and (ii) a controller that controls the flow control valve to control the amount of chemical injected into the at least one subsea well.
36. (currently amended) A system for injecting a chemical into formation fluid produced by at least one subsea well, comprising: (i) a surface facility supplying a desired chemical; and (ii) an underwater chemical injection unit receiving the chemical via a line from the surface facility and injecting the chemical into the formation fluid produced by the at least one subsea well by pumping the chemical into the flowing production fluid using a subsea pump flowing from the at least one subsea well to a surface location and before the production fluid reaches a surface location.
37. (Original) The system of claim 36 further comprising at least one sensor providing a measurement of a parameter of interest.

38. (Original) The system of claim 37 wherein the underwater chemical injection unit includes a controller that controls at least in part the injection of the chemical in response to the parameter of interest.

39. (currently amended) The system of claim 37 wherein the parameter of interest is one of: (i) a physical property of the formation fluid stored; (ii) a chemical property of the formation fluid; or (iii) a parameter relating to a device associated with the at least one subsea well.

40. (currently amended) The system of claim 36 wherein the chemical injection unit injects the chemical ~~at one of:~~ (i) at a location within the at least one wellbore; and (ii) at a location along conveying the production fluid between the at least one wellhead and a surface location at the seabed.

41. (Original) The system of claim 37 wherein the chemical supply system includes: (i) an underwater storage tank for storing the chemical therein; and (ii) a chemical supply unit at the sea surface that supplies the chemical to the underwater storage tank.

42. (Original) The system of claim 36 wherein the chemical supply system includes an underwater chemical storage tank that is adapted to be one of: (i) refillable by a remotely operated device and (ii) replaceable via a quick disconnect.